A subduction model for the Alps derived from geophysical results

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There are abundant physical, geochemical and geophysical data about the Eastern Alps for which a tectonic synthesis may be tried from a geophysical point of view.

It is geologically clear that the crust of the Eastern Alps has been shortened but this shortening is not reflected in the total crustal thickness indicated by seismic data. The average thickness of the crust does not exceed 35 to 40 km. This is in contrast with the 65 to 80 km thickness which would have resulted if all of a mixed continental and oceanic crust has been compressed and shortened by a factor of 2.5 or 3. Therefore, there is good reason to postulate that crustal material has disappeared. We have two models for such a process, AMPFERER's " Verschluckung " or plate-tectonic subduction of a lithospheric plate. It is difficult to determine which model better fits the geological facts and the known physical data because only the very last orogenic events are presently observable. There is no active Benioff zone in the Eastern Alps today — but a gravity high south of the Alps — and, although there is evidence of andesitic volcanism in the Southern Alps, this evidence is not sufficient to define a classical subduction model.

In the non-folded molasse trough of the foreland of the Alps there are numerous east-west striking faults which are downthrown towards south. They may be an effect of a bending of the crust down towards the Alps.

Nearly 55 km north of the border of the Alps, the iso-surfaces of seismic velocity in the crust start dipping southwards. In contrast, below and south of the Peri-Adriatic (or Insubric) line up to a depth of more than 30 km the iso-surfaces are practically horizontal. Consequently, there is a remarkable geophysical asymmetry of the Alpine region between the northern and southern molasse troughs.

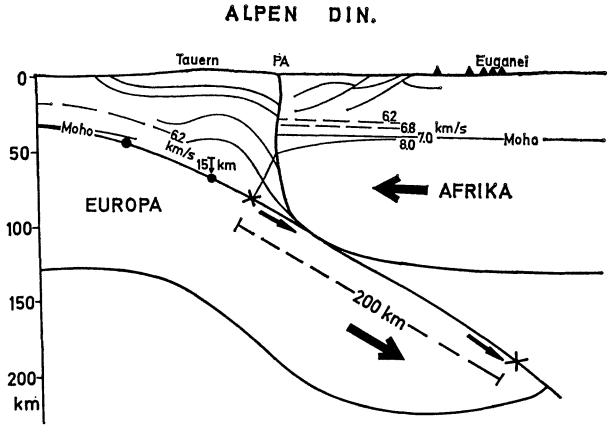

FIG. 1. : A cross section of the Eastern Alps about 20 million years b.P. Below the Tauern the Moho at that time is shown about 15 km deeper than calculated from recent refraction crustal investigations. A minimum figure for the subduction seems to be 200 km. PA = Periadriatic lineament. South of PA the results of recent seismic crustal studies are used.

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